ERIC Document Resume	See Instruction Sheet	DATE OF RESUME 7/13/65	DATE RECEIVED 7/12/65

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.	DO NOT WRITE IN SPACE BELOW
ED002116	N.A.	N.A.	

4. AUTHOR(S): Hatch, Winslow

5. TITLE OF DOCUMENT ABSTRACTED: Research in Class Size in Relationship to Effective Teaching

6. PUBLICATION TITLE: Junior College Journal

7. EDITOR(S): N.A.

8. PLACE OF ORIGIN: ORG. American Association of Junior Colleges; ST. 1315 16th Street, N.W.; CITY, STATE Washington, D.C.; TELE. EXT. INST/LOC CODE

9. PUBLISHER OR SOURCE: American Association of Junior Colleges 1315 16th Street, N.W., Washington, D.C.

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
XXXII	21-27	Sept. 1961	6

MICROFILM COPY AVAILABLE: YES ☒ NO ☐

COPYRIGHT GRANTED: YES ☒ NO ☐

COPYRIGHT RELEASE FILED: YES ☒ NO ☐

TYPE OF REPORT: PROPOSAL ☐ IN-PROGRESS ☐ FINAL ☒ FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR: Report

16. INDEXING TERMS (6-12)

class size	independent study			
junior colleges	teacher quality			
effective teaching	student inquiry			

17. ABSTRACT (MAX. 250 WORDS)

It is the consensus of research reports that the critical variable in teaching effectiveness in higher education is the quality of the teaching and of the subsequent learning, not class size. Of the various methods used to obtain quality teaching, problem-oriented approaches to teaching produced more and better learning than any other method. Problem-oriented approaches include not only problem solving, but also the Socratic method, use of case studies, independent study, and tutorial instruction.

Although class size is not the most critical factor in higher education, trends show that classes will be larger and that the student-faculty ratio will increase. This trend is based on such factors as enrollment pressures; available staff; and economic, social, and political pressures.

The independent study method can be used in these increasingly large classes. Large classes, combining many different elements of opinion, personality, and experience can be the vehicle for sparking the students' interest and for leading him to do independent study. The experience in large class discussions or lectures would be followed by smaller meetings, conferences, or tutorials.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. / PROJECT NO.
	22. TOTAL COST OF PROJECT	
	23. DURATION OF PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

ED002115

[Reprint from JUNIOR COLLEGE JOURNAL, September, 1961, VOL. XXXII, No. 1]

Research in Class Size in Relationship to Effective Teaching

WINSLOW HATCH

THE SUBJECT given me—and one with which I am quite happy—is "Research in Class Size in Relation to Effective Teaching."

My job, I take it, is to analyze the problem, to identify its elements—which I might add are many—to examine some of these elements, and finally to develop with you some working hypotheses.

Your job is to test these hypotheses.

A. The first element with which we must wrestle in our title is the word *teaching*. We need, at the outset, to decide what we mean by teaching in this year of our Lord, 1961. Is teaching the imparting of information? The answer—both yours and mine—must be, I think, *No*. It involves this, but it is more than this because learning is more than this.

"Effective teaching," the phrase in our title, must mean something more than the imparting of information (precisely, what it is, we will leave for another time and place).

But were it just this—the imparting of information—what do we know? We know a good deal, and it is relevant to our problem. We know:

—that research done on teaching effectiveness by the University of Michigan (refer to Parsons, Ketcham, and Beach) suggests that in the acquisition of facts, a teacher often distracts the student. The student may not retain the facts he learns entirely on his own as well as those he learns in some classes, but he is able to learn as many, if not more.

Then there is the estimate made by Pfnister (1958 Conference on Class Size, University of Michigan) that "if we are willing to agree that the proper criterion of student achievement is command of a certain content, contact hours between student and instructor may be slashed drastically without any apparently bad effect upon the amount of learning." One university recently reduced certain English classes from five to three hours a week and certain social science classes in the same manner and concluded that the average achievement of the student under the new arrangement was every bit as high as that under the old. Another experiment demonstrated that seven ten-minute conferences during the semester resulted in more gain in achievement in English composition than did a whole semester of group classwork. The outcome of independent study programs suggests that students in independent study learn at least as much as students engaged in regular classwork. Indeed, some research suggests that students studying by correspondence master course content as well as students engaged in resident study.

If this is true, and I'm afraid it is,—because there is a good deal of research supporting this thesis—what does it say to us about class size. It says that if teachers were to get out of the student's way, and students could be induced to dig out their facts, the class-size problem would not loom as large as it does.

B. The second element is to get on with our

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analysis and to approach this factor as though the previous one did not exist; let us pick up where we were a year ago when we did the "Effectiveness in Teaching" study (and so far as our study went, it did not exist). In our study of the research done on class size since 1957 (i.e. for the two years 1957–58) there was absolute consensus in 12 out of 12 research reports. The consensus was:

> *That class size is not the critical variable in teaching effectiveness in higher education; that it is rather the quality of the teaching (and of the learning).*

(*New Dimensions in Higher Education,* No. 2, U. S. Office of Education. This is now in its second printing. The first having been exhausted in two months.)

Criticism of this hypothesis was invited. The only criticisms received urged us to make clear (as I would want to make it clear to you) that this statement does not say that class size is not a factor in teaching effectiveness.

Looking at our 1959–60 hypothesis from the vantage point of 1961, two things need to be done. *One* is to examine the implications of the hypothesis as stated. The *other* is to examine the problem of size itself and a qualifier that we and McKeachie would like to introduce.

This order is suggested because our first concern should, it would seem, be for the critical variable, the quality of teaching, rather than that which is *not* or, at least, is less critical. Now the quality of teaching would seem to be reflected in the *quality* of learning. With this double emphasis on quality and this quick plunge into learning theory, practical men—and I number myself in this company—and will, with your indulgence, include you—are likely to throw up their hands and observe with some sharpness that "here we go again"—into that never, never land of the intangibles.

I'm not going to bog down here, but I would ask you to reserve judgment as to how intangible the quality and the conditions of learning are—how impractical they really are. Do we know so little about quality and so little about the quality of learning, and hence about the kind of teaching required, that we must throw in the sponge at the start of the fight? I think not.

I would, in fact, propose that there are objective and strictly professional ways of getting at quality, be it of learning or of teaching or of program or of your institution that one can, in fact, be explicit and specific about quality.

Let us look at the research done by the learning specialist. Be he a Tyler, a McKeachie or a Gagne, there is agreement (at least there is agreement among these three) that there are six desirable conditions of learning. There are, of course, more but were these conditions met, they would, I think, result in learning of high quality and teaching of good quality.

Another way of getting at quality goes clear outside of education (which is suspect even among some of us). It is to the evidence derived from the study of human genetics. What are the intellectual and cognitive-related attributes that have enabled man to adapt and survive? They are six, and they are the same six that the learning specialists feature.

I won't identify them because I do not want to bog down here, but they are available. More than this, the implications in these qualitative attributes for teaching have been examined and working hypotheses developed. I refer to two studies to appear in tee *New Dimensions* series: "Quality in the Undergraduate College" and "And Gladly Teach; As Well As We Know How." I might also add that the research done on the quality of the educational experience has also been reviewed in the *New Dimensions* series. The "Impact of College," *New Dimensions* No. 4, is another one of our "best sellers," temporarily out of print.

Let us, however, push on, for there is other research that brings us to the same place; it is very convincing, even impressive, to laymen like you and me. I refer to the data we first came upon in our study of teaching effectiveness. The conclusion reached in

each of 12 studies (this was our entire sample for the two years, 1957 and 1958) was that *problem-oriented approaches to teaching (and learning) are effective.* Since, in another section of the same review (eight research teams reporting), *no other one method could be demonstrated to produce more or better learning than another,* the research on "problem-oriented" teaching was conspicuous. Again, to be sure that we understand each other, by "problem-oriented" approaches we mean not only problem, but Socratic and case methods. We would also suggest that the "developmental discussion," work-study, independent study, including honors and tutorial instruction be included. Of the latter programs, it should be noted that they have been the object of intensive study during the last year. Socratic method has had a renaissance in connection with programming for teaching machines. The Harvard Graduate School of Business has completed a study and, as a consequence, is introducing more teacher direction into its famous case method. McKeachie has been publishing on developmental discussion. Work-study has been roundly endorsed by Tyler's committee. Independent studies and honors have received much, and, it would appear, deserved, attention. Even the interest in tutorial instruction has grown.

Inquiry, which is perhaps a better name for this instructional galaxy, characterizes every experimental college conceived or born during the year. *Inquiry* is finally the darling of learning specialists because it meets so many of what they are convinced are desirable conditions of learning. It is Gagne's "guided discovery," which he found to be twice as effective as "unguided discovery" and four times as effective as lecturer-recitation-type learning—according to his criteria of effectiveness. This would all seem to add up to the conclusion that in the problem or inquiry approach, we have something substantial and in an area which is often written off as gray, fuzzy and impractical.

C. This brings us to the problem of class size itself. Here one can make some pretty safe observations, too:

Classes will be larger; at least the student-faculty ratio will increase. Most of us are agreed that this is the case, but we would all like to be as sure about it as we can. A study that might be helpful is one in which a great many developments were examined—all that could be identified—to see what their effect would be upon the ratio. I refer to the summary sheet I have in my hand (and perhaps you have if we had enough to go around).

FACTORS IN STUDENT-TEACHER RATIO

1. Which *Will Alter* Ratio Upward:
   a. Enrollment pressures.
   b. Available staff.
   c. Economic, social and political pressures.
2. Which *Will Tend to Freeze or Lower* Ratio:
   a. Attitudes of students, teachers, institutions and public regarding the small class.
   b. Academic traditionalism and vested interests.
   c. Evidence of studies, undergraduate origins of graduate students.
   d. Expansion of traditional honors programs.
3. Which *May not Alter* Ratio but *Might Result in* Better Faculty Utilization:
   a. Advanced placement.
   b. Early entrance.
   c. Study abroad.
   d. Substitutes for the credit system.
   e. Fewer examinations, "reading for examinations."
4. Which *Could Alter* Ratio Upward:
   a. Reduction in undesirable proliferation and duplication of courses.
   b. "Core" or common curriculums.
   c. More prescription and less election in lower division (junior college) curriculums.
   d. Greater synthesis (integration) in presentation of subject matter.
   e. Emphasis on theory rather than application.
   f. "Liberalization" of "honors" programs, combined with general-liberal education programs.

g. Sub-professional assistance.
h. Greater inter-institutional and regional cooperation.
i. Sharper and narrower institutional objectives, administrative and faculty "controls."
j. Inter-departmentalization.
k. Effect of "impact" studies.
l. Impact of research on educational intangibles.
m. Impact of studies of institutional characteristics—institutional indices.
n. Impact of better informational services.
o. Impact of research on teaching methods.
p. Improving faculty salaries.
q. While negative in its initial effect early entrance and advanced placement which could better "fill" advanced classes.
r. Television in a sophisticated pedagogical and curricular context.
s. Independent study.

In general and in summary, it would appear that the factors pushing up the ratio are so many, and those depressing it so few, that it looks as if the ratio will not only climb but that the climb may be more rapid than expected—more rapid than if it were influenced by just the operation of the raw numbers involved, the number of students and of teachers. This simply reinforces our common sense.

Let us now look at the mechanics employed in handling numbers. What are the ways in which students are met?

1. *Large class meetings:* I was about to say lectures and to say that these lectures can be as large as you would have them, that there seems to be no special magic in lecture classes of 60, 120, 250, 500 or even more students—but this will stand examination.
   a. What else do we think we know—the medium employed, be it TV or kinescope or "straight" lecture, is not as critical as the quality of the lecturer's thinking and the degree he can get students to identify themselves with his inquiry.
   b. Such meetings should not be used to recite facts. There are apparently better and less expensive ways to teach facts. There is always the book, the chart, and pictures, still or moving. There is also the taped lecture, the expository lecture or demonstration done by experts. These are devices, when so used, for imparting information but in the strictest sense are not teaching devices, for they involve the student primarily in acquiring and memorizing facts. All of these devices should, of course, be used to reinforce a teacher's teaching.
   c. Using every skill and art at his command to involve students, the teacher of the large class may still want to make use of something that has the appearance of a one-sided conference in which, while only a few students are able to participate, there is some exchange and the other students are involved vicariously.
   d. The lecture is the place where questions are asked and problems identified, where problems are analyzed and the nature of relevant facts identified but not "taught." It is the place where the lecturer, after the students have discovered the relevant facts for themselves, takes the students' facts and helps them organize the information in a way that makes it susceptible to interpretation. It is the place where the lecturer demonstrates how one generalizes.
2. *The conference:* What do we know or think we know about the conference? One of the reasons that McKeachie thinks that size may have an unfortunate effect upon learning is that it is difficult in large classes to pursue those inquiries that seem essential if students are to use some of the intellectual skills required in problem solving. There also seems to be some desirability in engaging in the group process and in the exchange of ideas and in personalizing the learning process. What the size of such conferences should be depends upon the precise objectives the teacher has in mind for the confer-

ence. Conferences of six or seven are indicated if each student is to make a substantial contribution at each meeting. The top is about 20 if each conferee is to have much chance of making a contribution—according to Bloom.

There is, however, a school of thought, and this ought to be recognized, that believes that many of the advantages of conferences can be realized vicariously, that much learning can be done even if one does not himself participate in the conference. Actually, there are those who have found that conferences of 45, or even more, seem to be reasonably good learning experiences.

3. *The laboratory:* About the laboratory, the research done to date and of late indicates that as a learning experience it is much to be preferred over a demonstration (lecture or TV) if the laboratory is made, in fact, an experimental experience because in this instance the student has to do a lot of thinking as well as a lot of manipulating. In sum, the student is involved and learns by doing something more than use his eyesight or his ability to read (directions) or his memory.

In the three analyses we have made we have discovered that the research examined suggests that:

1. Students can dig out their own facts independently of a teacher—may even do it better—or can do this with much less supervision than has been thought necessary, but this leaves us with the knotty question, how practically is this to be managed in colleges as we know them and with the students you know best. But, since a principle has been enunciated on the basis of considerable research, our job and yours is primiraly one of adaptation and of implementation—for pilot experimentation. There is literature and there are models. In other words, there is much that is proven or pretty well proven. What there is least of is action, programs in being.
2. In our analysis of the "quality" research, we found that it is clear that so far as the effectiveness of teaching and learning is concerned, there is in the research literature and in operation something that in its consistent results and in its many manifestations has the appearance of being an educational breakthrough. Our reference is, of course, to those methods and programs that make good use of student inquiry and student talent.

But, here again, the junior college is faced with the problem of how best to adapt this experience and research to its special requirements. And for all colleges there is the problem of how can student fact-getting be meshed with student inquiry, and how can this be done on the scale in which it has to be done?

In our analysis of size, it is clear that despite what is done about the above statements there will be many students on our campuses. Class size will hardly be "beside the point" because we are still faced with the question of how these many students are to be handled most wisely and effectively. It is—and we would make the point again—more of a problem of educational engineering than of educational research.

Pursuing this idea further, the first suggestion that comes to mind is that the large class may be one of the ways, and for the part of the job it does one of the best ways, to fuse all of the elements discussed. Actually, it has been used this way and to good effect. If the large class were used as indicated below, it could be made (a) the vehicle by which the student's acquisition of fact could be given the necessary direction, (b) the vehicle in which the student's interest in such study (independent study) could perhaps be "sparked" and hopefully fanned into a hot enough flame, the instrument for getting the job done and on a large enough scale to make a difference.

The large class would simply be the place where the student—and large numbers of them—were introduced to effective learning, made possible in part by their own efforts. Their experience would be followed and supported by smaller meetings, conferences, colloquia, and even tutorials.

About independent study: The brand or variety of independent study employed will be dictated by local preferences, requirements and conditions. One reason for employing "problem-oriented" approaches and one reason that they have been visited with success is that they, too, involve students. The two are really different manifestations of the same idea. For our purposes, it would be useful to know that independent study has been successfully used in classes with as many as 450 students. What is done in this class, very briefly, is to ask all students to work at the same problem, always a significant one, and one that advances their understanding of the course. In general, the students do several different things. After the problem has been identified and they have been instructed how to determine relevancy, the students dig out their own facts. The second thing they do after the lecturer has organized their facts and shown them how one does, in fact, go about interpreting facts, is to attempt to make generalizations of their own and to push their inquiry as far as their ability or their time permits.

By carefully prepared examinations the students are finally tested to see if they can generalize, see, and understand the theoretical fabric of the course, its essential unity. In this course there was much trading of students by students. Edited transcripts are available of the lectures, conferences and laboratories employed.

Another final factor is, of course, the *quality of the teacher.* This is too large a subject to review here, but there are two aspects that should be mentioned because they have a direct bearing on what has been said.

1. There should be good teaching direction of the large course, the best available. Experience shows that not only are good teachers required but also perceptive scholarship. These may come in the same package, in the same person. They may come in different packages. In this instance it is possible to define "good teacher." On the strength of the research reported, he would be one who can use the problem or inquiry method effectively, one who has demonstrated his ability to set up conditions of learning that result in good learning. It is also possible to define "perceptive scholarship" for our purposes. It is that scholarship which enables one to identify significant and salient problems. That the identification of this teacher and this scholarship is necessary if students and teacher are to use effectively this tool of inquiry is self-evident.
2. There must be administrative recognition and reward for the kind of teaching indicated by the research reported. This one approach would have wide repercussions and might be the key to better staffing. If it were known, for example, that such recognition were real and substantial, one would hardly need to provide elaborate in-service programs. Were it known that teaching of this quality was wanted and rewarded, it would have an effect upon the institution's recruitment program and on training sought by prospective faculty members.

In all of this research, the implications for the junior college are interesting and pleasant to contemplate. To make a significant breakthrough in teaching, one needs only to understand the problems and to fuse the several elements into a pro-

gram. All of these elements have been tested; we have a lot of answers—*enough to do the job*—and with less risk than is entailed in waiting for the miracle. The problem is who will do it. Since a junior college can have as much gumption as a four-year college and is not so loaded with tradition, it can do this as soon as the university, and if it does what has to be done, it can do it as well. The junior college has, here, a chance to settle this matter of status once and for all. It could beat the four-year college at its own game.